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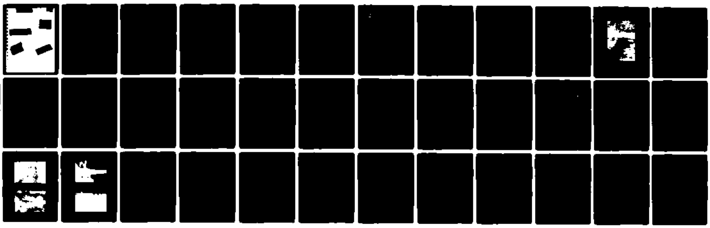

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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

3 August 1979

ERRATA

The following pages are a revised SECTION 7 for the Goff Springs Dam report. They contain information not previously included in that section and should be used in lieu of page 10 of this report.

SIGNED
JACK R. NIEMI
Chief. Engineering Division

Accession For

A

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety.

(1) Spillways. Inadequate spillway capacities are considered a deficiency which should be corrected.

(2) Dam. Corrective measures, in our opinion, should be taken immediately for the deficiencies visually observed; i.e., the steepness of the embankment, slope creep, small erosion channels, seepage, and springs in the right abutment, and uncontrolled vegetation on the downstream slope of embankment and erosion of the outlet channel.

(3) In our opinion, the services of a professional engineer experienced in the design of dams should be retained to evaluate these deficiencies.

b. Adequacy of Information. No engineering design and construction data was available and the conclusions of this report are based on performance and external visual conditions. The inspection team considers that these data are sufficient to support the conclusions herein. Seepage and stability analyses comparable to the requirements of the Recommended Guidelines (including seismic analyses) were not available and this is considered a deficiency which should be rectified.

c. Urgency. A program should be developed as soon as possible to monitor at regular intervals the deficiencies described in this report. The remedial measures recommended in paragraph 7.2 should be accomplished in the near future. The item recommended in paragraph 7.2.a should be pursued on a high priority basis.

d. Necessity for Phase II. Based on the result of the Phase I inspection, no Phase II inspection is recommended.

7.2 REMEDIAL MEASURES

a. Alternatives. The spillway will pass only 30 percent of the probable maximum flood without overtopping. The spillway capacity and/or height of dam should be increased to pass the probable maximum flood.

b. O&M Procedures. The following O&M procedures are recommended:

(1) Trees and excessive vegetation should be removed from the downstream slope.

(2) Seepage should be monitored to determine the quantity of flow and sedimentation and it is recommended that corrective measures be designed by an experienced professional engineer based on appropriate analyses.

(3) Spillway channel should be provided with erosion protection.

(4) Up-to-date records of all future maintenance and repairs should be kept.

(5) The dam should be periodically inspected by an engineer experienced in the design and construction of dams.

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Goff Springs Dam (Mo. 30905), Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Goff Springs Dam (Mo. 30905).

It was prepared under the National Program of Inspection of Non-Federal Dams.

The St. Louis District has classified this dam as unsafe and requiring prompt attention because of extensive seepage, steep embankment slopes, sloughing of the downstream slope and erosion of the spillway.

SIGNED

16 MAR 1979

SUBMITTED BY: ______________________ ______________
Chief, Engineering Division — Date

20 MAR 1979

APPROVED BY: ______________________ ______________
Colonel, CE, District Engineer — Date

GOFF SPRINGS DAM

ST. FRANCOIS COUNTY, MISSOURI

MISSOURI INVENTORY NO. 30905

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY

Kenneth Balk & Associates, Inc.
St. Louis, Missouri
Shannon & Wilson, Inc.
St. Louis, Missouri

PREPARED FOR

ST. LOUIS DISTRICT, CORPS OF ENGINEERS

SEPTEMBER, 1978

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	Goff Springs
State Located	Missouri
County Located	St. Francois County
Stream	Tributary To Bee Run Creek
Date of Inspection	August 2, 1978

Goff Springs Dam, Mo. No. 30905 was inspected using the "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed by the Chief of Engineers, U. S. Army, Washington, D.C., with the help of Federal and State agencies, professional engineering organizations, and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

Goff Springs Dam was visually inspected by an interdisciplinary team of engineers from Kenneth Balk & Associates, Inc. and Shannon & Wilson, Inc. The purpose of the inspection was to make a preliminary assessment of the general condition of the dam with respect to safety in order to determine if, in the opinion of the interdisciplinary team, the dam poses recognizable hazards to human life or property. This assessment is based solely upon data made available and visual evidence observed during the site visit.

To make a complete assessment of the safety of the dam would require detailed studies and engineering analyses beyond the scope of this preliminary assessment.

Based on the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. The estimated damage zone extends six miles downstream of the dam. Within the first half of a mile downstream of the dam are three low dams, one of which is about 300 feet downstream of the outfall of Goff Springs Lake. Also within the damage zone are one farmhouse with outbuildings, one improved road crossing, one State highway bridge over Big River, and one large chicken farm complex. Goff Springs Dam is in the intermediate size classification since it is greater than 40 feet high but less than 100 feet high.

The inspection and evaluation indicate that the spillway of Goff Springs Lake does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Goff Springs is an intermediate size dam with a high hazard potential, required by the guidelines to pass the PMF. Considering the high hazard potential to loss of life and property downstream of the dam, the outlet facilities of Goff Springs Dam should be able to pass the PMF without overtopping the dam. However, it was determined that the spillway will only pass approximately 30 percent of the PMF without overtopping the dam.

Since the outlet facilities for Goff Springs Lake are not capable of passing the PMF without overtopping the dam, the spillway is considered inadequate and the dam is accordingly classified as an unsafe, nonemergency structure.

The evaluation of Goff Springs Lake also indicated that the spillway will pass the 100-year flood; that is, a flood having a 1 percent chance of being equalled or exceeded during any given year.

Deficiencies visually observed by the inspection team were seepage and uncontrolled vegetation on the downstream slope of the embankment. Springs were found on the right abutment approximately 50 feet from the junction of the embankment and abutment. In addition, the visible embankment slopes are steeper than generally used for dams of this height. Other deficiencies, in our opinion, are the lack of seepage records, operational records, seepage and stability analyses comparable to the requirements of the recommended guidelines and seismic stability analyses.

We recommend that prompt action be undertaken to correct or control the deficiencies described. A detailed report discussing each of these deficiencies is attached.

Ervin H. Baumeyer
Ervin H. Baumeyer, P.E.
Principal-In-Charge
Kenneth Balk and Associates, Inc.
St. Louis, Missouri

Lutz Kunze
Lutz Kunze, P.E.
Principal Engineer
Shannon & Wilson, Inc.
St. Louis, Missouri

Overview of Lake and Dam

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
GOFF SPRINGS DAM - ID NO. 30905

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APPENDIX

LIST OF PLATES

LIST OF PHOTOGRAPHS

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of the Goff Springs Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon data made available and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earth structure built on Bee Run Creek in the northern part of St. Francois County, Missouri. Topography adjacent to the valley is steep. Most of the area in the vicinity of the dam is covered with a layer of residual soil over moderately weathered, gray, moderately hard, jointed dolomite. Topography in the vicinity of the dam is shown on Plate 1.

(2) The principal spillway consists of two 30" corrugated metal pipes located on the left abutment. There is an emergency overflow spillway located above the principal spillway, essentially consisting of a swale in the dam. The outlet channel is partially grouted, with sand/cement grout for a distance of 30 to 40 feet.

(3) Pertinent physical data are given in paragraph 1.3 below.

b. Location. The dam is located in the northern portion of St. Francois County, Missouri, as shown on Plate 2. The lake formed by the dam is on the Missouri-St. Francois County Bonne Terre quadrangle sheet in the SE 1/4 of Section 23, T38N, R4E.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Based on these criteria, this dam and impoundment is in the intermediate size category.

d. Hazard Classification. Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph c above. Based on referenced guidelines, this dam is in the High Hazard Classification.

e. Ownership. This dam is owned by American Triad Corporation, 2006 Truman Boulevard, Crystal City, Missouri 63019.

f. Purpose of Dam. The dam forms a recreational lake.

g. Design and Construction History: There are no known design plans or construction records. Information supplied by the Corps of Engineers, indicates that the construction of the dam was completed in 1973.

h. Normal Operating Procedure. No operating records were found. Outflow passes through uncontrolled spillways. Normal rainfall, runoff, spillway discharge, transpiration, and evaporation all combine to maintain a relatively stable water surface elevation.

1.3 PERTINENT DATA

a. Drainage Area - 151 acres.

b. Discharge at Damsite.

(1) 30 inch pipe spillways - 80.4 cfs. at maximum pool.

(2) Emergency spillway - 148.6 cfs. at maximum pool.

(3) Estimated experienced maximum flood - approximately two feet below top of dam.

c. Elevation (U.S.G.S.)

(1) Top of dam - 782.7±.

(2) Invert of pipe spillway - 777.9.

(3) Spillway Crest - 777.9.

(4) Streambed at Centerline of Dam - 710±.

(5) Maximum tailwater - unknown.

d. Reservoir. Length of maximum pool - 1900 feet ±.

e. Storage (Acre-feet).

(1) Top of dam - 24.

(2) Spillway crest - 20.

g. Dam.

(1) Type - earth embankment.

(2) Length - 500 feet.

(3) Height - 73 feet maximum.

(4) Top width - 8 feet.

(5) Side Slopes - (Measured by Brunton Compass in degrees and converted to ratios.)

(a) Downstream - Upper 15 ft. 0.854 H. to 1 V.Lower Slope - 1.75 H. to 1 V.

(b) Upstream - 1.2 H. to 1 V. to water line

(6) Zoning - unknown

(7) Impervious core - unknown

(8) Cutoff - unknown

(9) Grout curtain - unknown

h. Diversion and Regulating Tunnel. - None.

i. Principal Spillway.

(1) Type - two 30" diameter corrugated metal pipes.

(2) Crest elevation - 777.9 U.S.G.S.

j. Emergency Overflow Spillway

(1) Type - earth swale, generally trapezoidal to circular in section, located above the principal spillway pipes.

(2) Invert at lakeside 780.8 (USGS).

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design data were found to be readily available.

2.2 CONSTRUCTION

The dam was completed in 1973 according to information supplied by the Corps of Engineers. No other information was available.

2.3 OPERATION

No records of the maximum loading on the dam were available.

2.4 EVALUATION

a. Availability. No engineering or geological data were readily available.

b. Adequacy. No engineering data was made available to make a detailed assessment of the design, construction, and operation. The lack of seepage and stability analyses comparable to the requirements of the Recommended Guidelines is considered a deficiency which should be corrected. An engineer experienced in the design of dams should be retained to perform detailed seepage and stability analyses for appropriate loading conditions (including earthquake loads) and make the results a matter of record.

c. Validity. No valid engineering data on design were available.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

A. General. A visual inspection of the Goff Springs Dam was carried out on August 2, 1978. Personnel making the inspection were employees of Kenneth Balk and Associates, Inc. and Shannon and Wilson, Inc. of St. Louis and included civil, geotechnical, and structural engineers and an engineering geologist. Specific observations are discussed below.

B. Dam. The inspection team observed the following items at the dam. The dam is an earth structure with a narrow, irregular crest. The height of the dam was raised recently with random material containing soil and rock debris. The original crest of the dam could not be inspected for possible cracks due to this recent construction. The downstream face of the embankment below the steep upper slope is soft and marshy.

Light riprap without an apparent filter was noted on the upstream slope of embankment in fairly good condition. The right abutment of the dam at the crest apparently was prepared by excavating material from the abutment slope against which the embankment was placed. Seepage was found primarily at the contacts of dam with the abutments. Seepage in the lower half of the embankment height was more at the right abutment than on the left abutment. Total seepage downstream of the toe was estimated to be 20 to 50 gpm. In addition, small springs were noted approximately 50 feet downstream from the juncture of the dam and the right abutment.

Indications of some slope creep were observed at the contact of the embankment and the right abutment. Rain erosion on a small scale was also noted at scattered places on the downstream slope. The downstream slope was covered with blackberry bushes below the crest and a line of small trees, including cottonwoods, were growing approximately half-way up the slope. The dam has approximately 4.8 feet of freeboard.

C. Appurtenant Structures. The principal spillway, consisting of two 30 inch diameter CMP's is located at the juncture of the dam with the left abutment. From visual inspection, it was not possible to determine if the 30 inch CMP's are placed in the abutment or in the dam, but our impression is that they probably are placed within the dam. Above the two CMP's is an unlined emergency overflow, (see Photo 4). The spillway outlet channel is cut in residual soil with the first 30 to 40 feet of the channel surfaced with a sand-cement grout to minimize erosion. Downstream of the surfaced channel, the exposed residual soil is being eroded and the grouted portion is being undercut.

D. Reservoir Area. No wave wash, excessive erosion or slides were observed along the shore of the reservoir.

E. <u>Dam Site Geology</u>.

Left Abutment: Left abutment of the dam and the surrounding areas upstream and downstream are covered with a thick layer of red, silty clay containing some angular to subangular pieces of gray dolomite except about 1,000 feet downstream on the right abutment where a small bedrock outcrop is present. The outcrop consists of moderately jointed dolomite. Due to the small size of the outcrop, dip and strike of the joints could not be determined. No oolitic chert or mold-casts of gastropods, which are characteristics of the Eminence Formation or quartz druse which is characteristic of the Potosi Formation were observed; hence it is difficult to identify the formation by visual inspection.

Right Abutment: The right abutment and the surrounding area upstream and downstream are covered with a thick layer of silty clay containing some random pieces of gray, hard, compact, moderately weathered dolomite. These pieces are angular to subangular and range from one inch to three inches in size. No outcrop of bedrock is present.

3.2 EVALUATION

The conditions observed, in our opinion, are significant enough to indicate a need for immediate remedial action. In the opinion of the inspection team, the services of a professional engineer experienced in the design of dams should be obtained immediately to evaluate the deficiencies noted, i.e. the steepness of the embankment, slope creep, small erosion channels, seepage, uncontrolled vegetation on the downstream slope of embankment, and springs in the right abutment.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

No regulating structure exists at this dam. The lake level is affected by rainfall, runoff, evaporation, and the capacity of the uncontrolled spillways.

4.2 MAINTENANCE OF DAM

No maintenance records of the dam were available. The amount and size of the vegetation on the embankment suggest that maintenance, if any, has not been regular.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities exist.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

The inspection team is not aware of any existing warning system for this dam.

4.5 EVALUATION

In our opinion, a regular program of vegetation control is desirable and in view of the serious deficiencies noted, a warning system should be immediately established and maintained.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. There were no hydraulic and hydrological design data made available.

b. Experience Data. The drainage area and lake surface area are developed from USGS Bonne Terre Mo. Quadrangle. The spillway and dam layout are from surveys made during the inspection.

c. Visual Observations.

(1) The two 30 inch CMP pipe spillways and outlet channel are in adequate condition. The spillway outlet channel is located at the left or east abutment. Spillway discharges, in our opinion, will continue to erode the outlet channel and endanger the integrity of the dam.

(2) The discharge from the emergency overflow spillway, which is located above the pipe spillways, will also endanger the dam's integrity.

d. Overtopping Potential. The principal and overflow spillways have been found to be inadequate to pass the Probable Maximum Flood (PMF) without overtopping the dam. The probable maximum flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region.

For the PMF, the dam would be overtopped to a maximum height of approximately 2.6 feet with a duration of overtopping of approximately 5.5 hours and a maximum discharge rate of 1530 cfs. In our opinion, failure of the dam may be expected to occur as a result of overtopping for this length of time.

The spillways have been found to be adequate to pass a flood of approximately thirty percent (30%) of the PMF.

The spillways have been found to be adequate to pass the 100-year flood, which has a 1% chance of being equalled or exceeded at least once during any given year.

The estimated damage zone extends six miles downstream of the dam. Within the first half of a mile downstream of the dam are three low dams, one of which is about 300 feet downstream of the spillway channel outfall of Goff Springs Lake. Also within the damage zone are one farmhouse with outbuildings, one improved road crossing, one State highway bridge over Big River, and one large chicken farm complex.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visually observed conditions which can affect the structural stability of this dam have been discussed in Section 3.

b. Design and Construction Data. No design or construction data relating to the structural stability of the dam were found except that discussed in Section 1.2.

c. Operating Records. No appurtenant structures requiring operation exist at the dam.

d. Post-Construction Changes. No post-construction changes are known or apparent except that discussed in Section 3.

e. Seismic Stability. Goff Springs Dam is located in Seismic Zone 2. Since no engineering design data was available, an evaluation of the seismic stability of the dam could not be made and the effect of an earthquake of the magnitude expected in this zone on a dam of this type and size could not be assessed.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM AND SPILLWAY ASSESSMENT

a. Safety.

(1) Spillways - Inadequate spillway capacities are considered a deficiency which should be corrected.

(2) Dam - Corrective measures, in our opinion, should be taken immediately for the deficiencies visually observed, i.e., the steepness of the embankment, slope creep, small erosion channels, seepage, and springs in the right abutment, and uncontrolled vegetation on the downstream slope of embankment and erosion of the outlet channel.

Seepage and stability analyses comparable to the requirements of the 'Recommended Guidelines for Safety Inspection of Dams' were not available, which is considered a deficiency.

(3) In our opinion, the services of a professional engineer experienced in the design of dams should be retained to evaluate these deficiencies.

7.2 REMEDIAL MEASURES

a. O&M Procedures. The following O&M procedures are recommended and should be implemented immediately.

(1) Trees and excessive vegetation should be removed from the downstream slope.

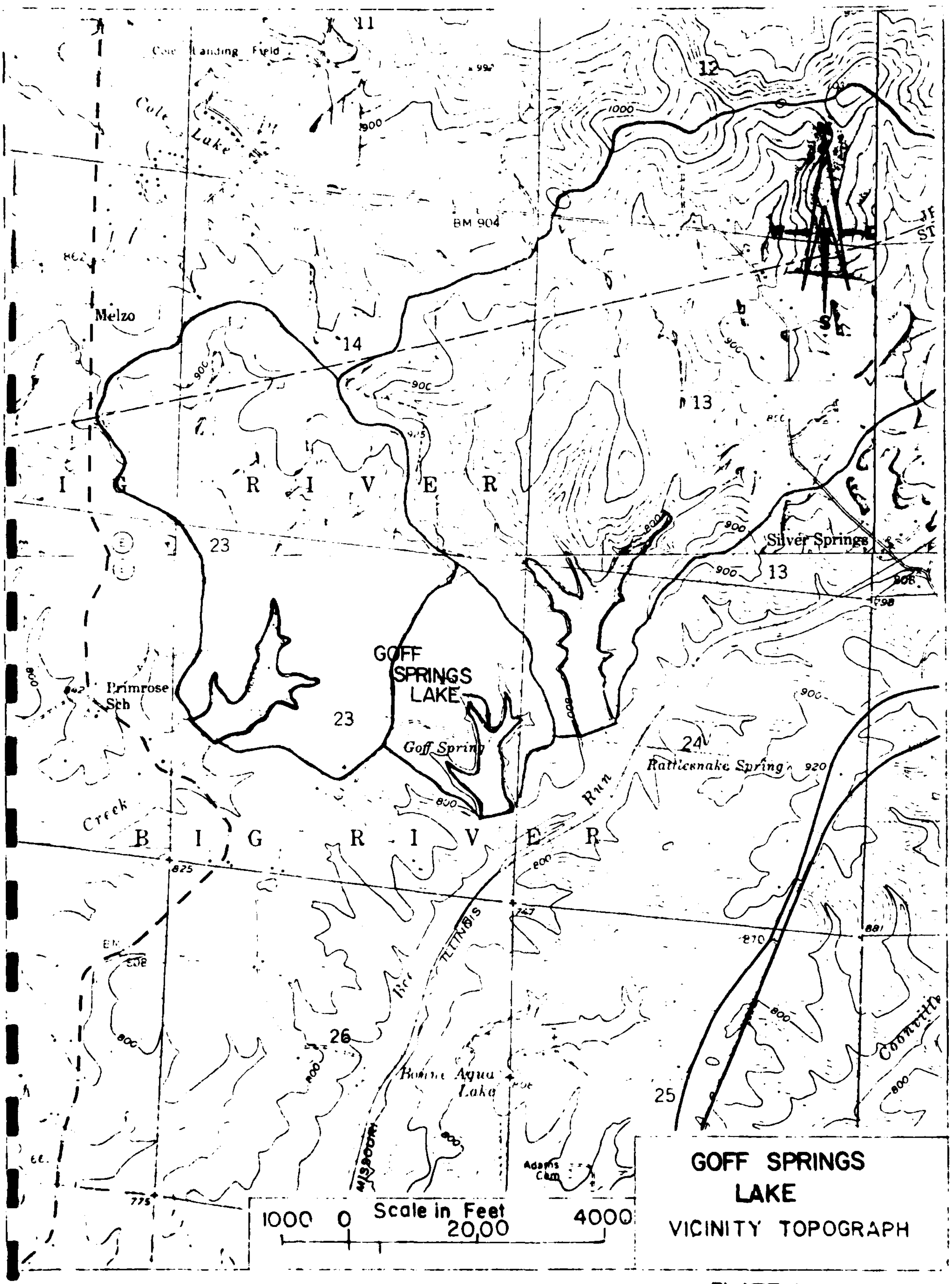
(2) Seepage should be monitored to determine the quantity of flow and sedimentation and it is recommended that corrective measures be designed by an experienced professional engineer based on appropriate analyses.

(3) Spillway channel should be provided with erosion protection.

(4) Up-to-date records of all future maintenance and repairs should be kept.

(5) Spillway capacity and/or height of dam should be increased to pass 100 percent (100%) of the Probable Maximum Flood.

(6) The dam should be periodically inspected by an engineer experienced in the design and construction of dams.



GOFF SPRINGS LAKE
Goff Spring
Melzo
Primrose Sch
Silver Springs
Rattlesnake Spring
BIG RIVER
Creek
Run
BM 904
Cole Lake
Bonne Aqua Lake
Adams Cam
Scale in Feet
1000 0 2000 4000
GOFF SPRINGS
LAKE
VICINITY TOPOGRAPH

PLATE I

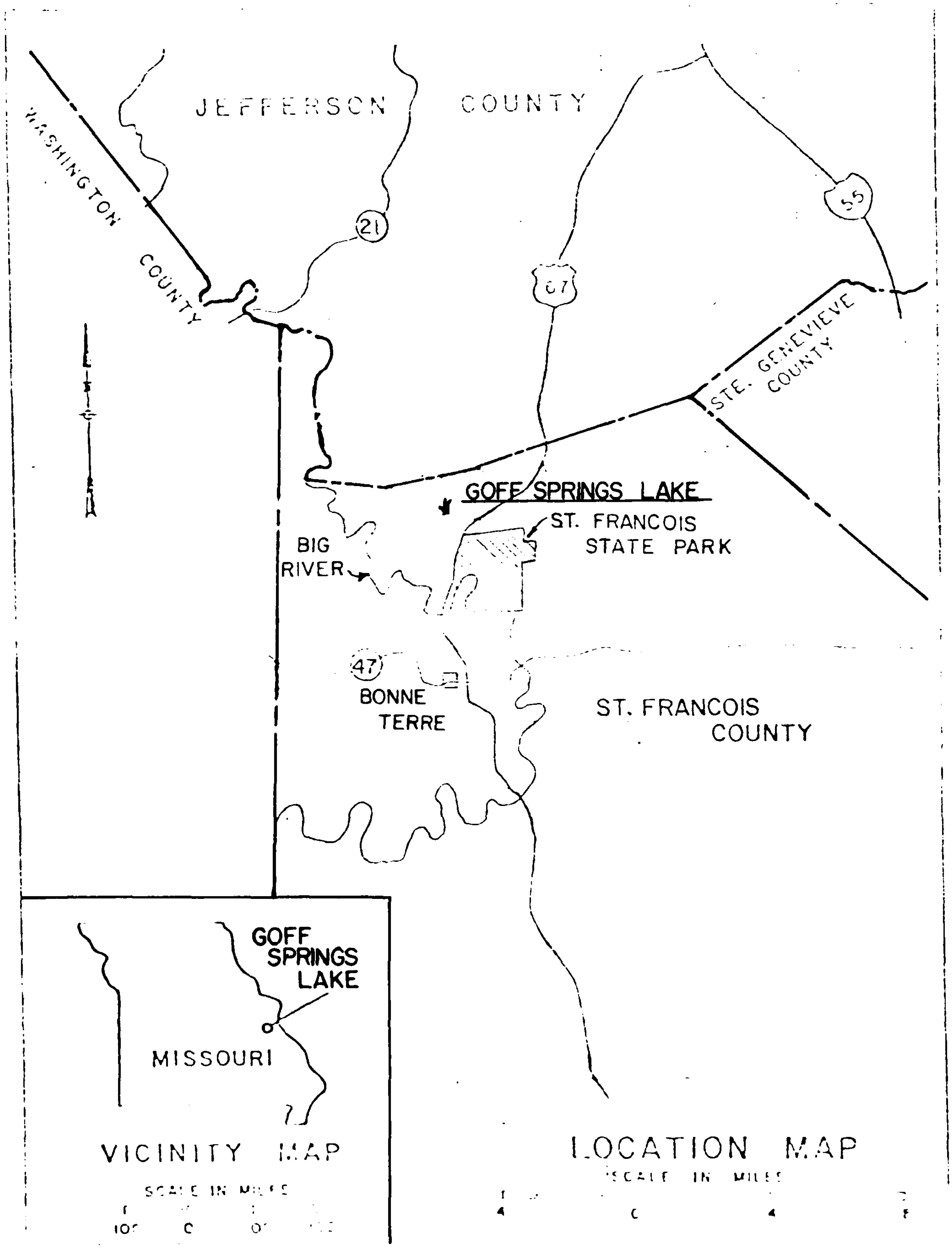
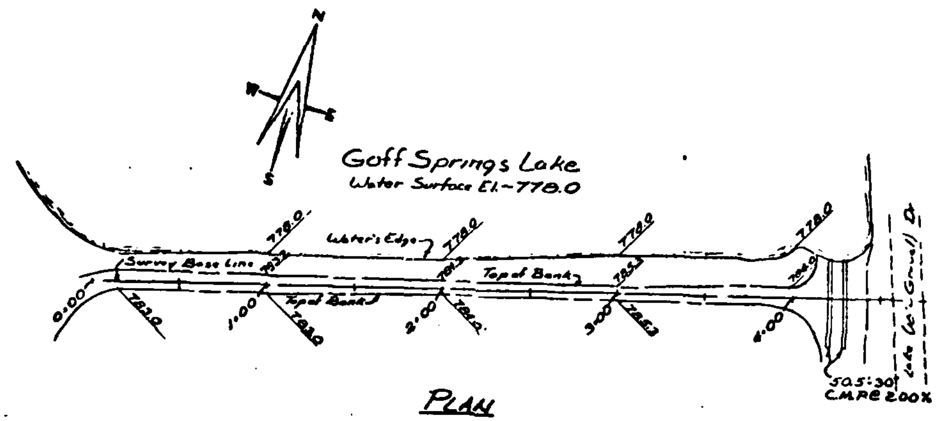

JEFFERSON COUNTY
WASHINGTON COUNTY
21
67
55
STE. GENEVIEVE COUNTY
GOFF SPRINGS LAKE
ST. FRANCOIS STATE PARK
BIG RIVER
47
BONNE TERRE
ST. FRANCOIS COUNTY
GOFF SPRINGS LAKE
MISSOURI
VICINITY MAP
LOCATION MAP
SCALE IN MILES

PLATE 2

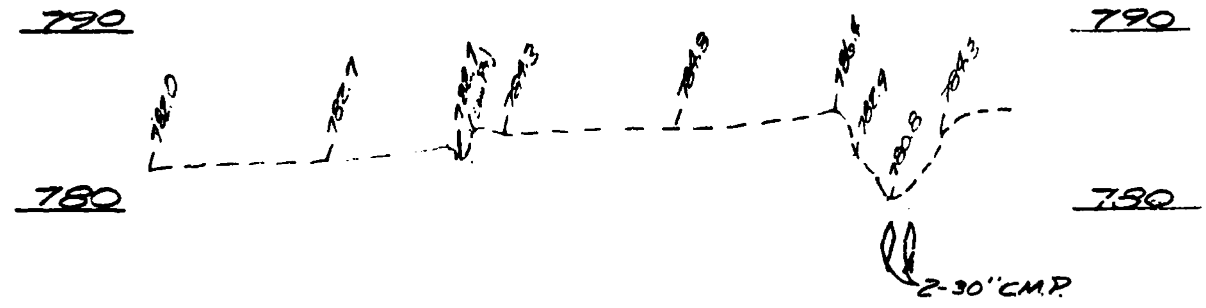


GOFF SPRINGS LAKE

TOP OF DAM
ELEVATIONS

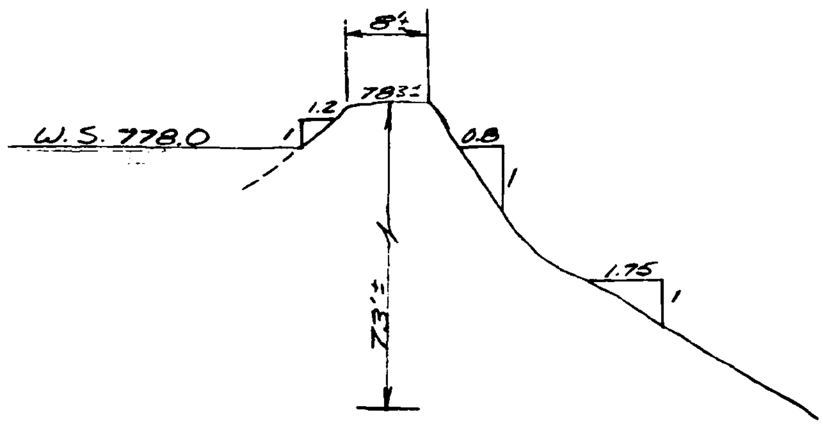
SCALE: 1"=100'±

PLATE 3



PROFILE

SCALE: 1" = 100' Horiz.
1" = 10' Vert.



TYPICAL CROSS SECTION

SCALE: 1" = 20' Horiz & Vert.

GOFF SPRINGS LAKE

DAM PROFILE

and CROSS SECTION

PLATE 4

PHOTO 1: Overview of Lake and Dam.

PHOTO 2 Crest of Dam

PHOTO 3: View along Crest showing Spillway Pipes.

PHOTO 4: Entrance of Spillway Pipes, Emergency Overflow above Pipes.

PHOTO 5: View of Upstream Face of Dam and Spillway from Left Bank.

PHOTO 6: View from Toe of Dam Looking up the Downstream Face.

APPENDIX A

HYDROLOGIC AND HYDRAULIC ANALYSIS METHODOLOGY

HYDROLOGIC AND HYDRAULIC ANALYSIS METHODOLOGY

1. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for a reservoir routing. The Probable Maximum Precipitation is derived and determined from regional charts prepared by the National Weather Service in "Hydrometeorological Report No. 33." Reduction factors have not been applied. A 24-hour storm duration is assumed with the total rainfall depth distributed over 6-hour periods in accordance with procedures outlined in EM 1110-2-1411 (SPF Determination). The maximum 6-hour rainfall period is then distributed to hourly increments by the same criteria. Within-the-hour distribution is based upon NOAA Technical Memorandum NWS HYDRO-35. The nonpeak 6-hour rainfall periods are distributed uniformly. All distributed values are arranged in a critical sequence by the SPF criteria. The final inflow hydrograph is produced by utilizing the Soil Conservation Service triangle unit hydrograph using Hydrologic Soils Group "B" and Antecedent Moisture Condition III, and SCS CN 82 used to determine rainfall excess.

2. The reservoir routing is accomplished by using Modified Puls routing techniques wherein the flood hydrograph is routed through lake storage. Hydraulic capacities of the outlet works, spillway, and crest of dam are used as outlet controls in the routing. Storage in the pool area is defined by an elevation-storage capacity curve. The hydraulic capacity of the outlet works, spillway, and top of dam are defined by elevation-discharge curves.

3. Dam overtopping analysis has been conducted by hydrologic methods for this dam and lake. This computation determines the percentage of the PMF hydrograph that the reservoir can contain without the dam being overtopped. An output summary in the hydrologic appendix displays this information as well as other characteristics of the simulated dam overtopping.

4. The above methodology has been accomplished for this report using the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. The numeric parameters estimated for this site are listed in the attached computer printout. Definitions of these variables are contained in the "User's Manual" for the computer program.

5. The inflow hydrograph was routed through the reservoir using HEC-1's Modified Puls option. Releases were calculated for: 1) the principal spillway and, 2) the overflow spillway, and 3) the flow over the top of the dam. These releases were then combined at each of their respective elevations.

Flow through the principal spillway, two 30 inch diameter corrugated metal pipes, approximately 50.5 feet in length was obtained as follows:

<u>For Part Full Flow</u>:

Stage = E.G. + h_e

Where Stage = Pool Elevation

E.G. = Energy Gradient Elevation in pipe = $d_f + \frac{V^2}{2g}$

h_e = entrance loss = $k_e \frac{V^2}{2g}$, with

k_e = 0.5

d_f = depth of flow for a given discharge

$\frac{V^2}{2g}$ = velocity head

The equation then reduces to:

$$\text{Stage} = IE + d_f + 1.5 \frac{V^2}{2g}$$

Where IE = Invert elevation upstream = 777.94

<u>For Full And More Than Full Flow</u>:

$$\text{Stage} = IE + D + \frac{V^2}{2g} + h_f + h_e$$

Where Stage = Pool Elevation

IE = Invert elevation downstream = 776.65

D = Diameter of pipe = 2.5 feet

$\frac{V^2}{2g}$ = Velocity head

h_f = Friction loss = $\left(\frac{Q}{K_c}\right)^2 \times L$

Q = Discharge in cfs.

K_c = Conveyance coefficient = 213.3

L = Length = 50.5 feet

h_e = Entrance loss = $k_e \frac{V2}{2g}$, with $k_e = 0.5$

With proper substitution of numbers, the equation reduces to:

$$Q = \left(\frac{\text{stage}-779.15}{.00208}\right)^{\frac{1}{2}}$$

Flow through the overflow spillway and over the top of dam was calculated using the weir flow equation:

$$Q = CL(H)^{1.5}$$

where: C = Varies with head as outlined in "Handbook of Hydraulics" by Horace Williams King, revised by Ernest F. Brater.

L = Length in feet (varies with water surface)

H = Head of water in feet (varies with water surface)

Q = Discharge in cfs

```
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFFTY VFRSION      JULY 1978
  LAST MODIFICATION  3 AUG 7A
********************************
A1                          GOFF SPRINGS DAM
A2                           OCT. 30, 1978
A3                         MO. INV. NO.30905
B      288      -0       5      -0      -0      -0      -0      -0      -4      -0
B1       5
J        1       6       1
J1     .20     .30     .35     .40     .50    1.00
K        0  INFLOW                               3
M        1       2     .24                       1                       1
P               26     100     120     130
T                                                       -1     -82             .05
W2              .2
X     -.48     -.1       3
K        1 ROUTING                       2       2
Y                                1       1
Y1       1                                         -777.94      -1
Y4777.94    778.00  778.50  779.00  779.50  780.00  780.50  781.00  781.50  782.00
Y4782.50    783.00  783.50  784.00
Y5       0     .19    3.17    7.36   15.93   25.45   38.22   53.80   90.97  121.08
Y5198.33    311.09  579.67  848.25
$S       0     .91    8.48   16.04   23.61   31.18   39.42   47.66   55.90   64.14
$S 72.38     82.55   94.01  105.46
$E777.94    778.00  778.50  779.00  779.50  780.00  780.50  781.00  781.50  782.00
$E782.50    783.00  783.50  784.00
$$777.94
$D782.70
K       99
```

COMPUTER INPUT DATA

```
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  3 AUG 78
********************************

RUN  DATED 11/27/78.
     TIMED 17.21.26.


                                        GOFF SPRINGS DAM
                                         OCT. 30, 1978
                                       MO. INV. NO.30905

                                          JOB SPECIFICATION
               NQ       NHR      NMIN      IDAY      IHR      IMIN     METRC      IPLT      IPRT     NSTAN
              288        -0         5        -0       -0        -0        -0        -0        -4        -0
                                          JOPER      NWT     LROPT     TRACE
                                              5       -0        -0        -0


                                     MULTI-PLAN ANALYSES TO BE PERFORMED
                                        NPLAN= 1 NRTIO= 6 LRTIO= 1
               RTIOS=     .20     .30     .35     .40     .50    1.00


          **********          **********          **********          **********          **********

                                        SUB-AREA RUNOFF COMPUTATION
                          ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    IAUTO
                         INFLOW        0       -0       -0       -0        3       -0       -0       -0

                                              HYDROGRAPH DATA
               IHYDG     IUHG    TAREA     SNAP    TRSDA    TRSPC    RATIO    ISNOW    ISAME    LOCAL
                   1        2      .24    -0.00      .24     1.00   -0.000       -0        1       -0

                                                PRECIP DATA
                           SPFE      PMS       R6      R12      R24      R48      R72      R96
                          -0.00    26.00   100.00   120.00   130.00    -0.00    -0.00    -0.00

                                                 LOSS DATA
          LROPT    STRKR    DLTKR    RTIOL    ERAIN    STRKS    RTIOK    STRTL    CNSTL    ALSMX    RTIMP
             -0    -0.00    -0.00     1.00    -0.00    -0.00     1.00    -1.00   -82.00    -0.00      .05

               CURVE NO =  -82.00  WETNESS =   -1.00  EFFECT CN =   82.00

                                           UNIT HYDROGRAPH DATA
                                       TC= -0.00      LAG=   .20

                                               RECESSION DATA
                               STRTQ=     -.48     QRCSN=     -.10     RTIOR= 3.00

               UNIT HYDROGRAPH 14 END OF PERIOD ORDINATES, TC=    -0.00 HOURS, LAG=    .20  VOL= 1.00
          117.       386.       478.       382.       213.       122.        69.        40.        23.        13.
            7.         4.         2.         1.

      0                                          END-OF-PERIOD FLOW
   MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q      MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q

    1.01    .05       1    .01    .00    .01        0.       1.01  12.05     145    .22    .20    .02      140.
    1.01    .10       2    .01    .00    .01        0.       1.01  12.10     146    .22    .20    .01      192.
    1.01    .15       3    .01    .00    .01        1.       1.01  12.15     147    .22    .20    .01      257.
    1.01    .20       4    .01    .00    .01        1.       1.01  12.20     148    .22    .20    .01      309.
    1.01    .25       5    .01    .00    .01        1.       1.01  12.25     149    .22    .20    .01      339.
```

INPUT UNIT HYDROGRAPH

1.01	.30	6	.01	.00	.01	1.	1.01	12.30	150	.22	.20	.01	356.
1.01	.35	7	.01	.00	.01	1.	1.01	12.35	151	.22	.21	.01	367.
1.01	.40	8	.01	.00	.01	1.	1.01	12.40	152	.22	.21	.01	373.
1.01	.45	9	.01	.00	.01	1.	1.01	12.45	153	.22	.21	.01	377.
1.01	.50	10	.01	.00	.01	1.	1.01	12.50	154	.22	.21	.01	380.
1.01	.55	11	.01	.00	.01	1.	1.01	12.55	155	.22	.21	.01	382.
1.01	1.00	12	.01	.00	.01	1.	1.01	13.00	156	.22	.21	.01	383.
1.01	1.05	13	.01	.00	.01	1.	1.01	13.05	157	.26	.25	.01	399.
1.01	1.10	14	.01	.00	.01	1.	1.01	13.10	158	.26	.25	.01	406.
1.01	1.15	15	.01	.00	.01	1.	1.01	13.15	159	.26	.25	.01	427.
1.01	1.20	16	.01	.00	.01	1.	1.01	13.20	160	.26	.25	.01	443.
1.01	1.25	17	.01	.00	.01	1.	1.01	13.25	161	.26	.25	.01	453.
1.01	1.30	18	.01	.00	.01	1.	1.01	13.30	162	.26	.25	.01	459.
1.01	1.35	19	.01	.00	.01	1.	1.01	13.35	163	.26	.25	.01	463.
1.01	1.40	20	.01	.00	.01	1.	1.01	13.40	164	.26	.25	.01	465.
1.01	1.45	21	.01	.00	.01	1.	1.01	13.45	165	.26	.25	.01	467.
1.01	1.50	22	.01	.00	.01	1.	1.01	13.50	166	.26	.25	.01	468.
1.01	1.55	23	.01	.00	.01	1.	1.01	13.55	167	.26	.25	.01	469.
1.01	2.00	24	.01	.00	.01	1.	1.01	14.00	168	.26	.25	.01	469.
1.01	2.05	25	.01	.00	.01	1.	1.01	14.05	169	.32	.32	.01	477.
1.01	2.10	26	.01	.00	.01	1.	1.01	14.10	170	.32	.32	.01	503.
1.01	2.15	27	.01	.00	.01	1.	1.01	14.15	171	.32	.32	.01	533.
1.01	2.20	28	.01	.00	.01	1.	1.01	14.20	172	.32	.32	.01	558.
1.01	2.25	29	.01	.00	.01	1.	1.01	14.25	173	.32	.32	.01	572.
1.01	2.30	30	.01	.00	.01	1.	1.01	14.30	174	.32	.32	.01	581.
1.01	2.35	31	.01	.00	.01	1.	1.01	14.35	175	.32	.32	.01	586.
1.01	2.40	32	.01	.00	.01	1.	1.01	14.40	176	.32	.32	.01	589.
1.01	2.45	33	.01	.00	.01	1.	1.01	14.45	177	.32	.32	.01	591.
1.01	2.50	34	.01	.00	.01	2.	1.01	14.50	178	.32	.32	.01	592.
1.01	2.55	35	.01	.00	.01	2.	1.01	14.55	179	.32	.32	.01	593.
1.01	3.00	36	.01	.00	.01	2.	1.01	15.00	180	.32	.32	.00	593.
1.01	3.05	37	.01	.00	.01	2.	1.01	15.05	181	.20	.19	.00	579.
1.01	3.10	38	.01	.00	.01	3.	1.01	15.10	182	.40	.39	.01	554.
1.01	3.15	39	.01	.00	.01	3.	1.01	15.15	183	.40	.39	.01	569.
1.01	3.20	40	.01	.00	.01	3.	1.01	15.20	184	.59	.59	.01	638.
1.01	3.25	41	.01	.00	.01	4.	1.01	15.25	185	.69	.68	.01	773.
1.01	3.30	42	.01	.00	.01	4.	1.01	15.30	186	1.68	1.66	.02	1044.
1.01	3.35	43	.01	.00	.01	4.	1.01	15.35	187	2.77	2.74	.02	1685.
1.01	3.40	44	.01	.00	.01	4.	1.01	15.40	188	1.09	1.08	.01	2462.
1.01	3.45	45	.01	.00	.01	5.	1.01	15.45	189	.69	.69	.00	2715.
1.01	3.50	46	.01	.00	.01	5.	1.01	15.50	190	.59	.59	.00	2407.
1.01	3.55	47	.01	.00	.01	5.	1.01	15.55	191	.40	.39	.00	1888.
1.01	4.00	48	.01	.00	.01	6.	1.01	16.00	192	.40	.39	.00	1471.
1.01	4.05	49	.01	.00	.01	6.	1.01	16.05	193	.30	.30	.00	1162.
1.01	4.10	50	.01	.00	.01	6.	1.01	16.10	194	.30	.30	.00	936.
1.01	4.15	51	.01	.00	.01	6.	1.01	16.15	195	.30	.30	.00	785.
1.01	4.20	52	.01	.00	.01	7.	1.01	16.20	196	.30	.30	.00	688.
1.01	4.25	53	.01	.00	.01	7.	1.01	16.25	197	.30	.30	.00	633.
1.01	4.30	54	.01	.00	.01	7.	1.01	16.30	198	.30	.30	.00	602.
1.01	4.35	55	.01	.00	.01	7.	1.01	16.35	199	.30	.30	.00	583.
1.01	4.40	56	.01	.00	.01	7.	1.01	16.40	200	.30	.30	.00	571.
1.01	4.45	57	.01	.00	.01	8.	1.01	16.45	201	.30	.30	.00	565.
1.01	4.50	58	.01	.00	.01	8.	1.01	16.50	202	.30	.30	.00	563.
1.01	4.55	59	.01	.00	.01	8.	1.01	16.55	203	.30	.30	.00	561.
1.01	5.00	60	.01	.00	.01	8.	1.01	17.00	204	.30	.30	.00	561.
1.01	5.05	61	.01	.00	.01	9.	1.01	17.05	205	.24	.24	.00	553.
1.01	5.10	62	.01	.00	.01	9.	1.01	17.10	206	.24	.24	.00	528.
1.01	5.15	63	.01	.01	.01	9.	1.01	17.15	207	.24	.24	.00	497.
1.01	5.20	64	.01	.01	.01	9.	1.01	17.20	208	.24	.24	.00	473.
1.01	5.25	65	.01	.01	.01	9.	1.01	17.25	209	.24	.24	.00	459.
1.01	5.30	66	.01	.01	.01	9.	1.01	17.30	210	.24	.24	.00	451.
1.01	5.35	67	.01	.01	.01	10.	1.01	17.35	211	.24	.24	.00	447.
1.01	5.40	68	.01	.01	.01	10.	1.01	17.40	212	.24	.24	.00	444.
1.01	5.45	69	.01	.01	.01	10.	1.01	17.45	213	.24	.24	.00	443.
1.01	5.50	70	.01	.01	.01	10.	1.01	17.50	214	.24	.24	.00	442.
1.01	5.55	71	.01	.01	.01	10.	1.01	17.55	215	.24	.24	.00	441.

INPUT UNIT HYDROGRAPH

1.01	[illegible]	72	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.24	[illegible]	[illegible]
1.01	6.05	73	.07	.03	.04	14.	1.01	18.05	217	.02	.02	.00	416.
1.01	6.10	74	.07	.03	.04	24.	1.01	18.10	218	.02	.02	.00	332.
1.01	6.15	75	.07	.03	.04	37.	1.01	18.15	219	.02	.02	.00	260.
1.01	6.20	76	.07	.04	.04	48.	1.01	18.20	220	.02	.02	.00	233.
1.01	6.25	77	.07	.04	.03	56.	1.01	18.25	221	.02	.02	.00	209.
1.01	6.30	78	.07	.04	.03	62.	1.01	18.30	222	.02	.02	.00	187.
1.01	6.35	79	.07	.04	.03	67.	1.01	18.35	223	.02	.02	.00	168.
1.01	6.40	80	.07	.04	.03	70.	1.01	18.40	224	.02	.02	.00	150.
1.01	6.45	81	.07	.04	.03	74.	1.01	18.45	225	.02	.02	.00	134.
1.01	6.50	82	.07	.04	.03	77.	1.01	18.50	226	.02	.02	.00	120.
1.01	6.55	83	.07	.05	.03	79.	1.01	18.55	227	.02	.02	.00	108.
1.01	7.00	84	.07	.05	.03	82.	1.01	19.00	228	.02	.02	.00	97.
1.01	7.05	85	.07	.05	.02	84.	1.01	19.05	229	.02	.02	.00	87.
1.01	7.10	86	.07	.05	.02	86.	1.01	19.10	230	.02	.02	.00	78.
1.01	7.15	87	.07	.05	.02	88.	1.01	19.15	231	.02	.02	.00	70.
1.01	7.20	88	.07	.05	.02	90.	1.01	19.20	232	.02	.02	.00	62.
1.01	7.25	89	.07	.05	.02	91.	1.01	19.25	233	.02	.02	.00	56.
1.01	7.30	90	.07	.05	.02	93.	1.01	19.30	234	.02	.02	.00	50.
1.01	7.35	91	.07	.05	.02	94.	1.01	19.35	235	.02	.02	.00	45.
1.01	7.40	92	.07	.05	.02	96.	1.01	19.40	236	.02	.02	.00	40.
1.01	7.45	93	.07	.05	.02	97.	1.01	19.45	237	.02	.02	.00	40.
1.01	7.50	94	.07	.05	.02	98.	1.01	19.50	238	.02	.02	.00	40.
1.01	7.55	95	.07	.06	.02	100.	1.01	19.55	239	.02	.02	.00	40.
1.01	8.00	96	.07	.06	.02	101.	1.01	20.00	240	.02	.02	.00	40.
1.01	8.05	97	.07	.06	.02	102.	1.01	20.05	241	.02	.02	.00	40.
1.01	8.10	98	.07	.06	.02	103.	1.01	20.10	242	.02	.02	.00	40.
1.01	8.15	99	.07	.06	.01	104.	1.01	20.15	243	.02	.02	.00	40.
1.01	8.20	100	.07	.06	.01	105.	1.01	20.20	244	.02	.02	.00	40.
1.01	8.25	101	.07	.06	.01	106.	1.01	20.25	245	.02	.02	.00	40.
1.01	8.30	102	.07	.06	.01	107.	1.01	20.30	246	.02	.02	.00	40.
1.01	8.35	103	.07	.06	.01	107.	1.01	20.35	247	.02	.02	.00	40.
1.01	8.40	104	.07	.06	.01	108.	1.01	20.40	248	.02	.02	.00	40.
1.01	8.45	105	.07	.06	.01	109.	1.01	20.45	249	.02	.02	.00	40.
1.01	8.50	106	.07	.06	.01	110.	1.01	20.50	250	.02	.02	.00	40.
1.01	8.55	107	.07	.06	.01	110.	1.01	20.55	251	.02	.02	.00	40.
1.01	9.00	108	.07	.06	.01	111.	1.01	21.00	252	.02	.02	.00	40.
1.01	9.05	109	.07	.06	.01	112.	1.01	21.05	253	.02	.02	.00	40.
1.01	9.10	110	.07	.06	.01	112.	1.01	21.10	254	.02	.02	.00	40.
1.01	9.15	111	.07	.06	.01	113.	1.01	21.15	255	.02	.02	.00	40.
1.01	9.20	112	.07	.06	.01	113.	1.01	21.20	256	.02	.02	.00	40.
1.01	9.25	113	.07	.06	.01	114.	1.01	21.25	257	.02	.02	.00	40.
1.01	9.30	114	.07	.06	.01	115.	1.01	21.30	258	.02	.02	.00	40.
1.01	9.35	115	.07	.06	.01	115.	1.01	21.35	259	.02	.02	.00	40.
1.01	9.40	116	.07	.06	.01	115.	1.01	21.40	260	.02	.02	.00	40.
1.01	9.45	117	.07	.06	.01	116.	1.01	21.45	261	.02	.02	.00	40.
1.01	9.50	118	.07	.06	.01	116.	1.01	21.50	262	.02	.02	.00	40.
1.01	9.55	119	.07	.06	.01	117.	1.01	21.55	263	.02	.02	.00	40.
1.01	10.00	120	.07	.06	.01	117.	1.01	22.00	264	.02	.02	.00	40.
1.01	10.05	121	.07	.06	.01	118.	1.01	22.05	265	.02	.02	.00	40.
1.01	10.10	122	.07	.06	.01	118.	1.01	22.10	266	.02	.02	.00	40.
1.01	10.15	123	.07	.06	.01	118.	1.01	22.15	267	.02	.02	.00	40.
1.01	10.20	124	.07	.06	.01	119.	1.01	22.20	268	.02	.02	.00	40.
1.01	10.25	125	.07	.06	.01	119.	1.01	22.25	269	.02	.02	.00	40.
1.01	10.30	126	.07	.06	.01	119.	1.01	22.30	270	.02	.02	.00	40.
1.01	10.35	127	.07	.06	.01	120.	1.01	22.35	271	.02	.02	.00	40.
1.01	10.40	128	.07	.07	.01	120.	1.01	22.40	272	.02	.02	.00	40.
1.01	10.45	129	.07	.07	.01	120.	1.01	22.45	273	.02	.02	.00	40.
1.01	10.50	130	.07	.07	.01	121.	1.01	22.50	274	.02	.02	.00	40.
1.01	10.55	131	.07	.07	.01	121.	1.01	22.55	275	.02	.02	.00	40.
1.01	11.00	132	.07	.07	.01	121.	1.01	23.00	276	.02	.02	.00	40.
1.01	11.05	133	.07	.07	.01	121.	1.01	23.05	277	.02	.02	.00	40.
1.01	11.10	134	.07	.07	.01	122.	1.01	23.10	278	.02	.02	.00	40.
1.01	11.15	135	.07	.07	.01	122.	1.01	23.15	279	.02	.02	.00	40.
1.01	11.20	136	.07	.07	.01	122.	1.01	23.20	280	.02	.02	.00	40.
1.01	11.25	137	.07	.07	.01	122.	1.01	23.25	281	.02	.02	.00	40.

INPUT UNIT HYDROGRAPH

1.01	11.30	138	.07	.07	.01	123.	1.01	23.30	282	.02	.02	.00	40.
1.01	11.35	139	.07	.07	.01	123.	1.01	23.35	283	.02	.02	.00	40.
1.01	11.40	140	.07	.07	.01	123.	1.01	23.40	284	.02	.02	.00	40.
1.01	11.45	141	.07	.07	.01	123.	1.01	23.45	285	.02	.02	.00	40.
1.01	11.50	142	.07	.07	.01	124.	1.01	23.50	286	.02	.02	.00	40.
1.01	11.55	143	.07	.07	.01	124.	1.01	23.55	287	.02	.02	.00	40.
1.01	12.00	144	.07	.07	.01	124.	1.02	0.00	288	.02	.02	.00	40.
									SUM	33.80	31.43	2.37	59254.
										(859.)	(798.)	(60.)	(1677.89)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2715.	653.	206.	206.	59246.
CMS	77.	18.	6.	6.	1678.
INCHES		25.32	31.89	31.89	31.89
MM		643.09	810.10	810.10	810.10
AC-FT		324.	408.	408.	408.
THOUS CU M		400.	503.	503.	503.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	543.	131.	41.	41.	11849.
CMS	15.	4.	1.	1.	336.
INCHES		5.06	6.38	6.38	6.38
MM		128.62	162.02	162.02	162.02
AC-FT		65.	82.	82.	82.
THOUS CU M		80.	101.	101.	101.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	815.	196.	62.	62.	17774.
CMS	23.	6.	2.	2.	503.
INCHES		7.60	9.57	9.57	9.57
MM		192.93	243.03	243.03	243.03
AC-FT		97.	122.	122.	122.
THOUS CU M		120.	151.	151.	151.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	950.	229.	72.	72.	20736.
CMS	27.	6.	2.	2.	587.
INCHES		8.86	11.16	11.16	11.16
MM		225.08	283.53	283.53	283.53
AC-FT		113.	143.	143.	143.
THOUS CU M		140.	176.	176.	176.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 4

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1086.	261.	82.	82.	23698.
CMS	31.	7.	2.	2.	671.
INCHES		10.13	12.76	12.76	12.76
MM		257.24	324.04	324.04	324.04
AC-FT		130.	163.	163.	163.
THOUS CU M		160.	201.	201.	201.

INPUT UNIT HYDROGRAPH

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	777.94	777.94	782.70
STORAGE	0.	0.	76.
OUTFLOW	0.	0.	243.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	781.44	0.00	55.	87.	0.00	18.00	0.00
.30	782.49	0.00	72.	197.	0.00	16.42	0.00
.35	782.88	.18	80.	284.	1.08	16.25	0.00
.40	783.18	.48	87.	408.	1.92	16.17	0.00
.50	783.64	.94	97.	654.	2.75	16.08	0.00
1.00	785.27	2.57	135.	1530.	5.50	16.00	0.00

COMPUTER SUMMARY ANALYSIS

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